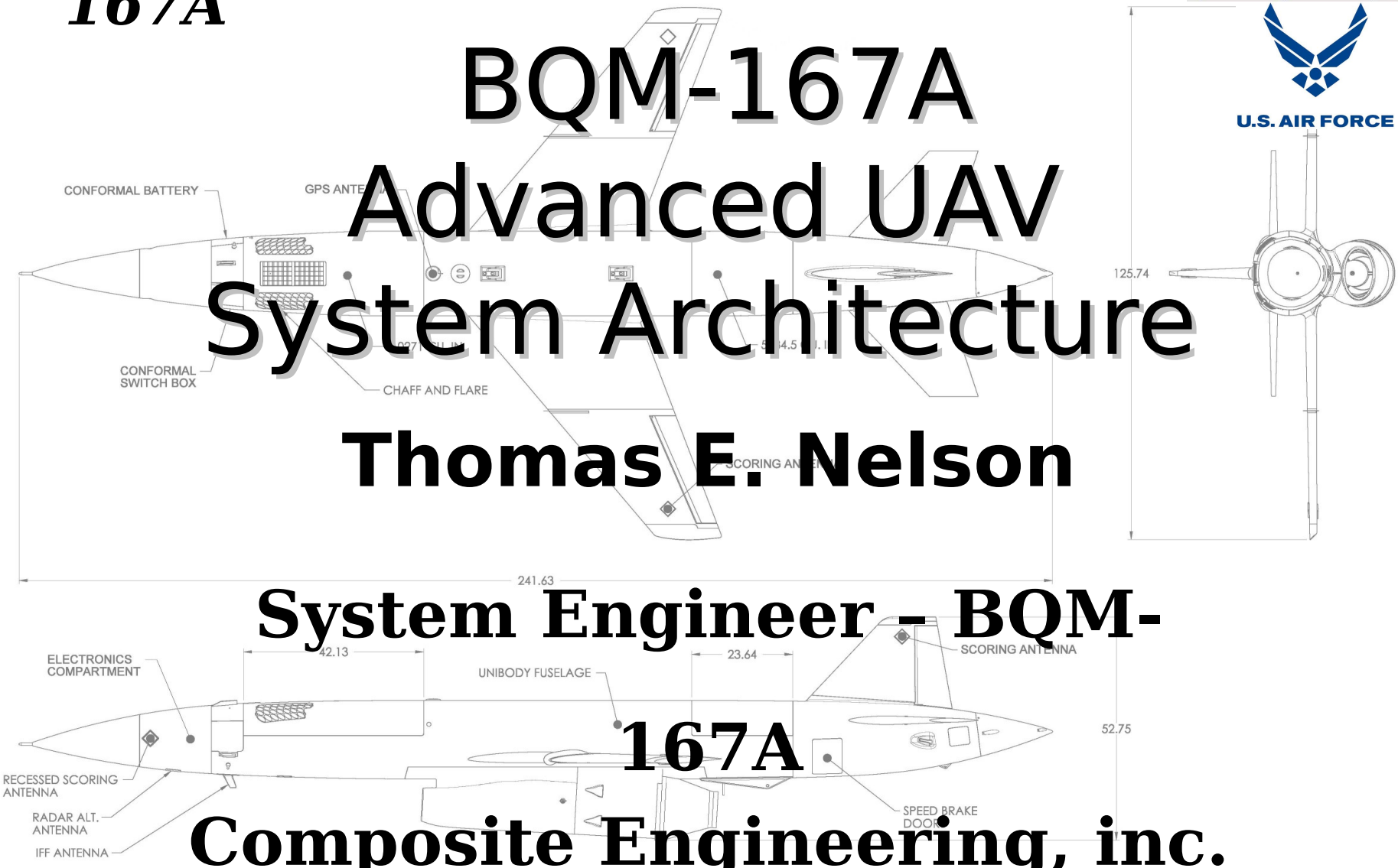
BQM-167A

BQM-167A Advanced UAV System Architecture



Thomas E. Nelson

System Engineer – BQM-167A

Composite Engineering, inc.

What is the ***BQM-167A***?

BQM-167A High Performance Subscale Aerial Target

BQM-167A

The CEi Objective

- Provide Advanced Replacement for Existing High Subsonic Aerial Targets
- Integrate New Engine with Greater Thrust and Better Efficiency
- Improved Shape for Better Performance and Increased Fuel and Payload Capacity
- Advanced System Architecture with Microelectronics

BQM-167A AFSAT Requirements

- Endurance
  - 60 min. at 15k ft., 30 of 60 at MIL power
- Airspeed Range
  - 250 KCAS to .90 Mach
- Formation Flight
  - Up to 4 Aircraft
- Threat Representative Maneuvers
- Payloads
  - 300 pounds total
    - Internal = 100 pounds + growth capacity
    - Wings = 150 pounds per Wing
- Launch Modes
  - Land
- Recovery
  - Land & Water

BQM-167A AFSAT Requirements

- Sustained g @ 10k ft
  - -2g to +6g
- Operating Altitude
  - 50 ft to 50k ft
- Payload Systems
  - ALE-47
  - EA Pods
  - IR Augmentation
- Visual Augmentation
  - Smoke
  - Paint
  - Strobe Light
- Control System
  - Manually Flown
  - Automated Maneuvers

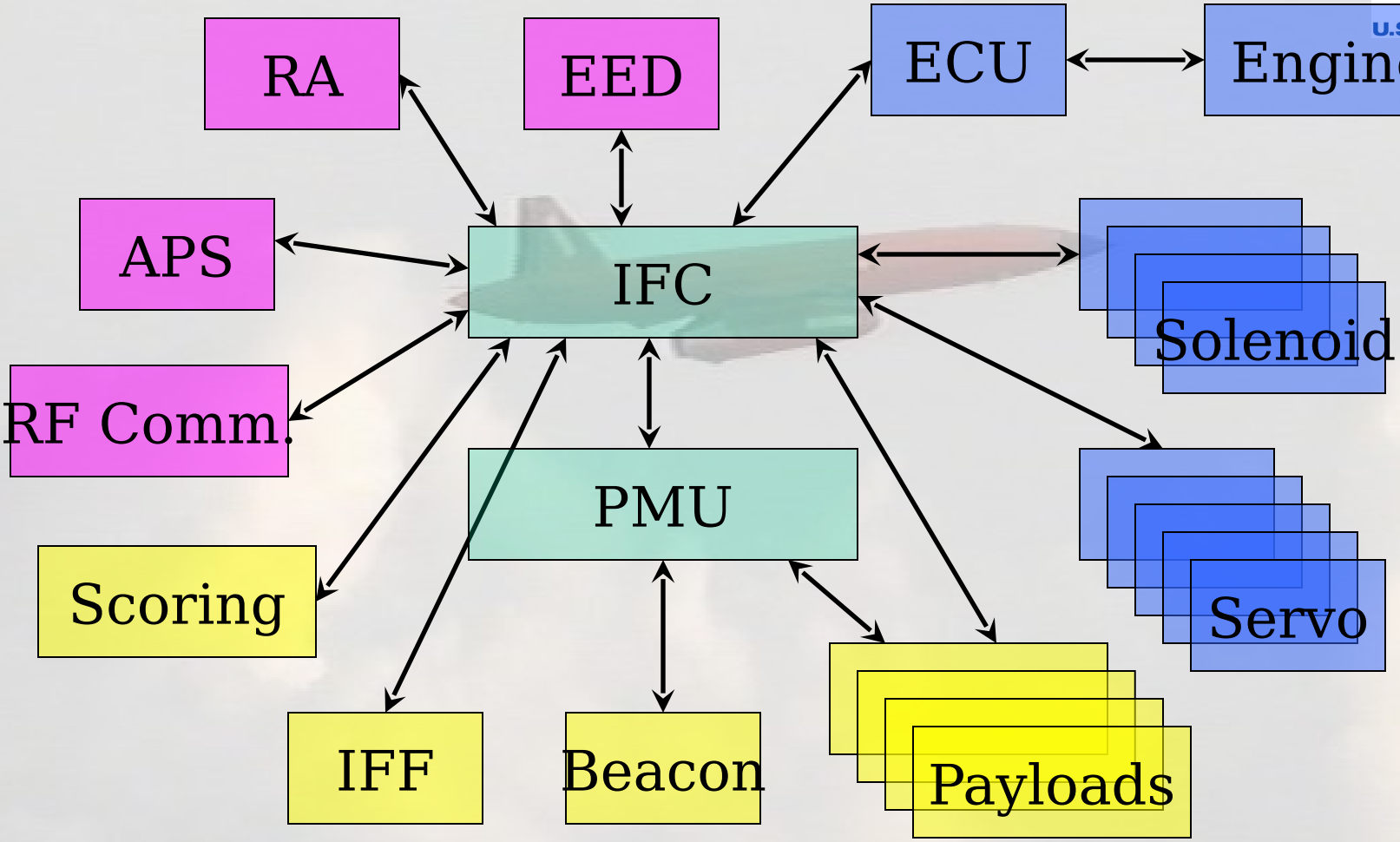
BQM-167A

Internal Emphasis

- Configuration Flexibility
  - Increased Fuel and Payload Capacity
  - Flexible Engine Options
- Significantly Reduced System Cost
  - Reduced Parts Count
  - OTS Materials and Hardware
  - Maintainability/Reparability
- Available Power and Volume for Payloads

BQM-167A

Distributed Digital Architecture



BQM-167A

Spare Digital / Analog Signals

- Communications Channels
  - RS-232, RS-422, and CAN Buses
- D-to-A and A-to-D Signals
  - 16-, 12-, and 8- Bits
- Payload and Spare Discrete Controls
  - Ground, Open, and 28 VDC
- Relay Activation Controls
  - 5, 15, and 25 Amp
- Servo Actuator Controls

BQM-167A Software Architecture

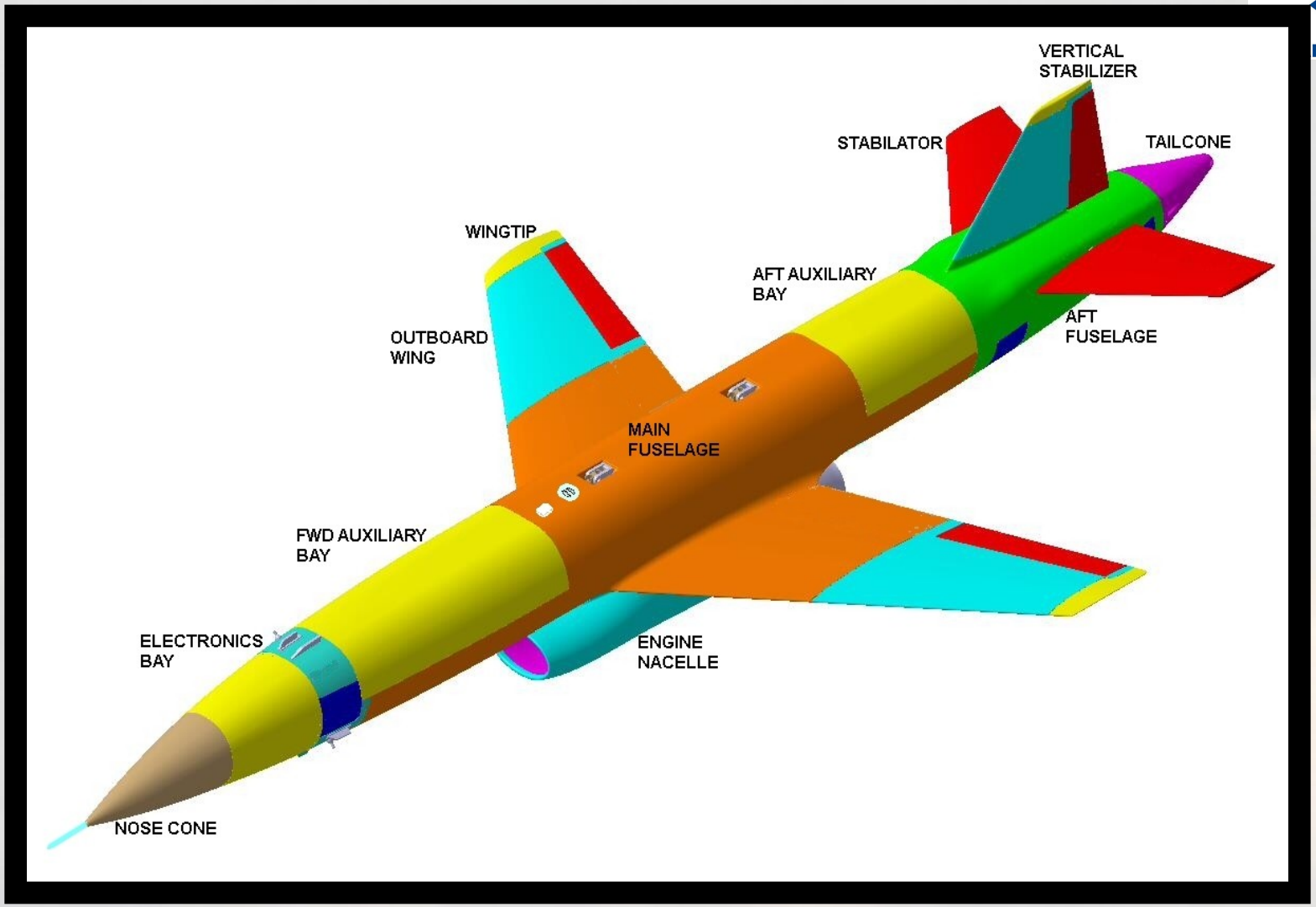
- Integrated Flight Controller
  - C++ Code, Interrupt Based Operations (10mSec timer)
  - Control Laws Implement Autopilot Operations
  - Special Vehicle Interfaces and Controls
  - Upgradeable to JAUS Standard/Compliance
- GRDCS Communications
  - Digital Signal Processor, RS-422 Serial Communications, RF Command and Control
- Autopilot Sensor
  - C++ Code, RS-422 Serial, Full Integrated Navigation System (INS) solution, 17-State Kalman Filter

BQM-167A Software Architecture

- Engine Control Unit
  - C++ Code, RS-422 Serial, Total Engine Operations
- ALE-47 System
  - C++ Code, RS-422 Serial, ALE-47 Sequencer Operations
- IFF System
  - C++ Code, RS-422 Serial, Mode 3A / 3C Operations
- Umbilical System and Testing
  - National Instrument LabView Code, RS-422 Serial, Command, Control, and Test Operations

BQM-167A

Airframe Layout



BQM-167A Specifications

Length	20.1 feet
Span (Clean)	10.5 feet
Maximum Weight	2050 pounds
Maximum Speed	0.93 Mach
Maximum Altitude	50,000+ feet
Maneuverability	9g @ 10,000+ feet
Maximum Climb	25,000 feet/minute
Propulsion	1000 lb. thrust turbojet
Maximum Endurance	Over 3 hours

BQM-167A

Flight Performance Demonstration

U.S. AIR FORCE

- Demonstrated Predicted Performance and Payload Capabilities
- Demonstrated Operational and Maintainability Aspects
- Quickly Resolved Anomalies (All Minor)

BQM-167A Launch & Recovery

BQM-167A

Demonstrated Flight Performance

- Maximum Airspeed – 0.90+ Mach
- Payload Carriage
  - 150 lb / Wing
  - 300+ lb Internal
  - 7.0 Cubic Feet
- Maximum Altitude – 51,600 feet
- Maneuverability – 9g Sustained 11,000 feet

BQM-167A

Demonstrated Flight Performance

- Land & Water Recovery
- Manual & Automated Control
- Preprogrammed Maneuvers
  - G-Turns (Airspeed & Altitude Hold)
  - Barrel Roll
  - Constant G Weave
  - Split-S
  - Slice & Pitchback

BQM-167A

Major Program Milestones

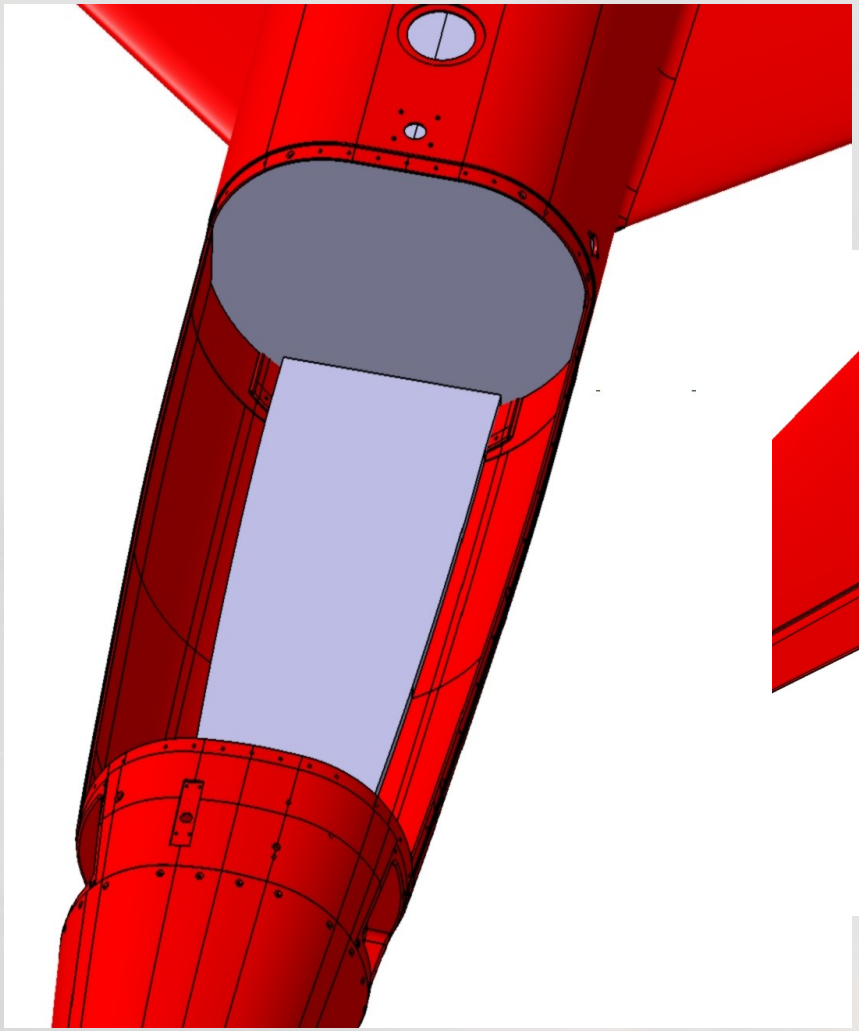
BQM-167A

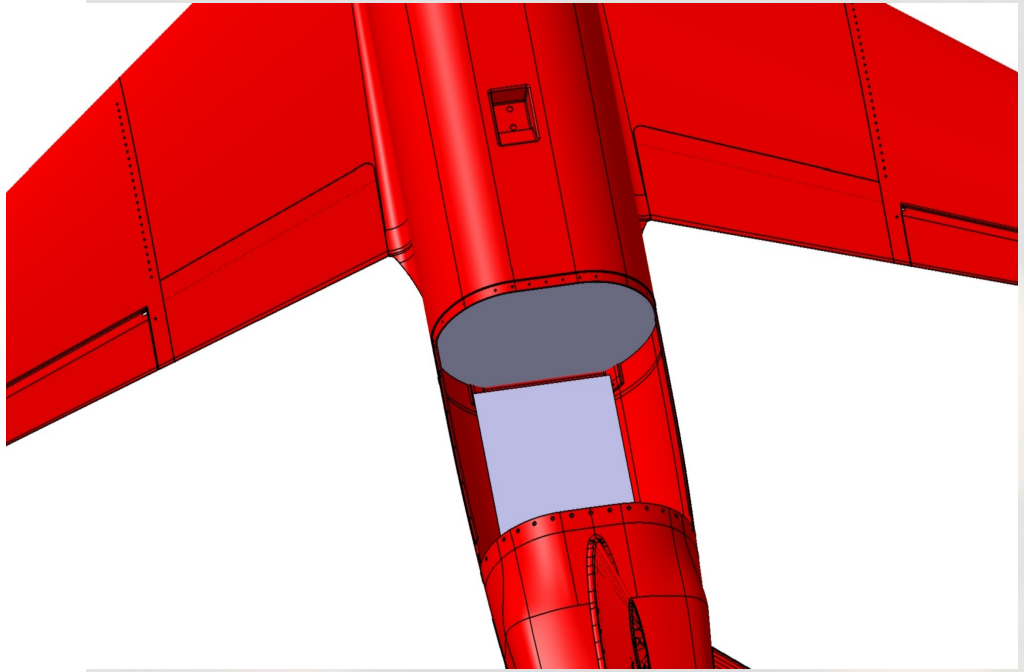
Current Activities

- Flight Performance Demonstration
  - First FPD Flight December 8, 2004
  - 10 of 12 Flights Completed
  - No Airframes Lost or Significantly Damaged
  - Demonstrated 95% of Requirements by Flight 6
- LRIP 1&2 On Order – 48 Aircraft Total
  - Delivered First Articles (2 Aircraft) in Oct. 2004

Future of the ***BQM-167A***

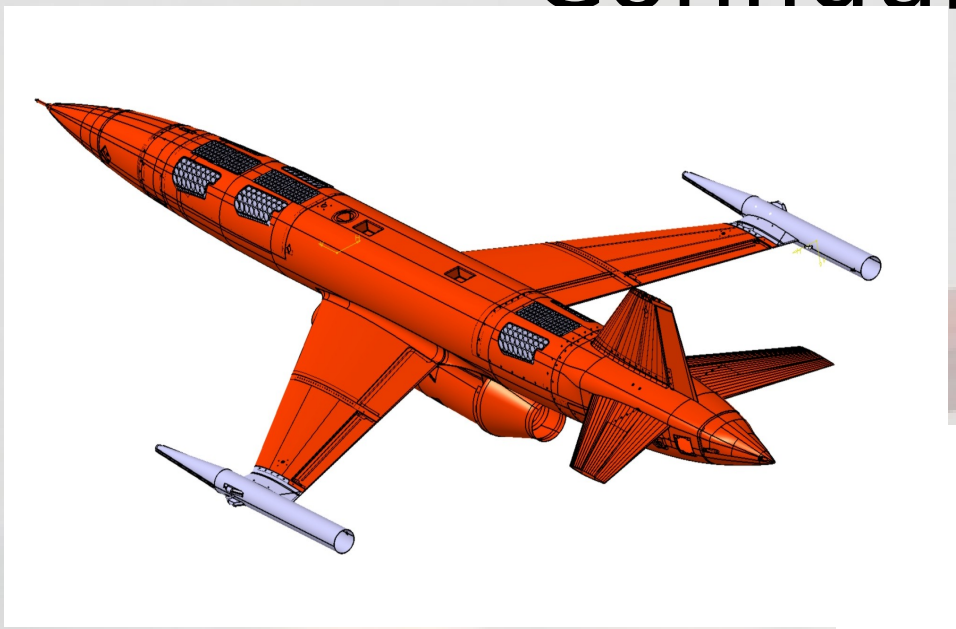
BQM-167A Payloads Expansion

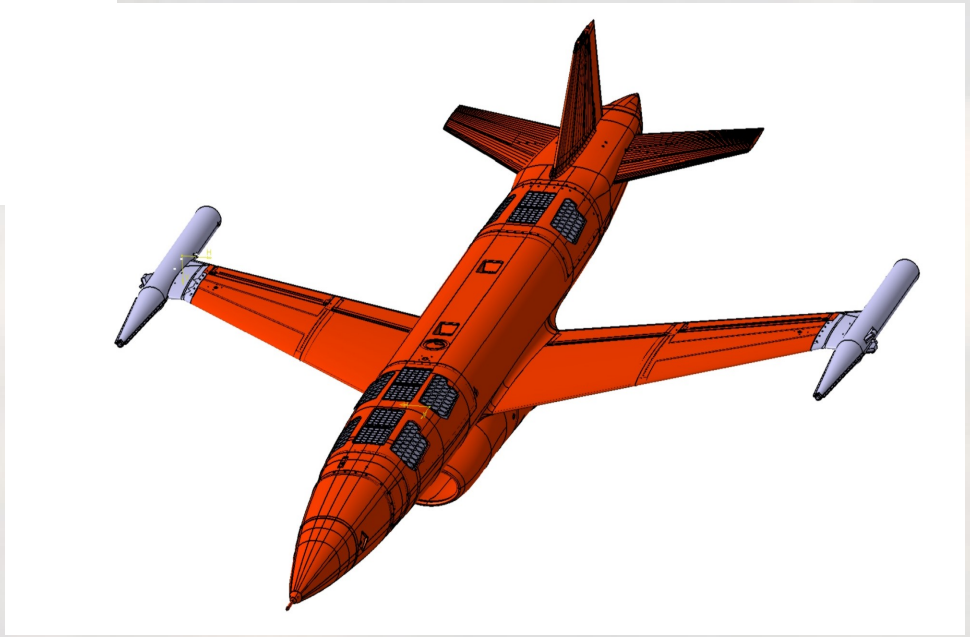




BQM-167A

Expanded IR Configuration





BQM-167A

Enhanced EA Configuration

U.S. AIR FORCE

BQM-167A Imminent Milestones

- Ground Support Equipment
- First Spares Order
- New Launch Rail Delivery in Nov. 2005
- FAAT Aircraft Delivery in Oct. 2005
- FAAT Flights Start in Nov. 2005
- IOC Scheduled for June 2006

U.S. AIR FORCE

BQM-167A Program Lessons Learned

BQM-167A Government-Contractor Team

- Open technical communications between Government-Contractor team members
- Common objective lead to distribute system architecture with spares and expandability
- Distributed architecture enabled concurrent engineering activities to occur

Working Together With a Common Vision,

"The Best Target for the Customer"

BQM-167A, Multi-role UAV

QUESTIONS?